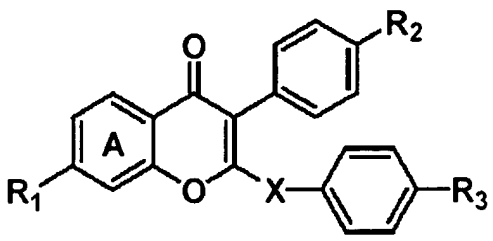
CLAIMS

The invention claimed is

1. A compound of formula A:

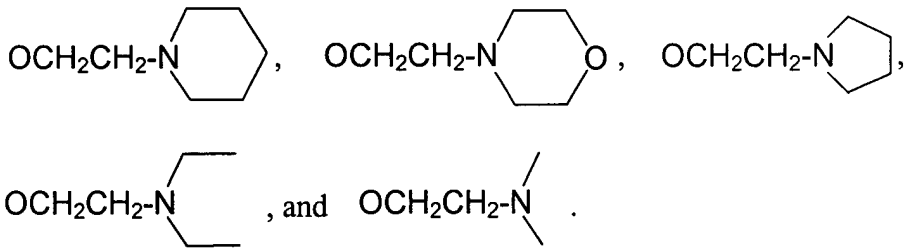


wherein

X is selected from the group consisting of O, N, S, SO, and SO_2;

R_1 and R_2 can be the same or different and are selected from the group consisting of H, OH, OCH_3, OCH_2CH_3, $OCH_2C_6H_5$, NH_2, $NHCH_3$, $N(CH_3)_2$, CN, CH_3, CH_2CH_3, $CH_2CH_2CH_3$, $CH(CH_3)_2$, $C(CH_3)_3$, NO_2, F, Cl, Br, CF_3, SH, SCH_3, SCH_2CH_3, OCOCH3, $OCOC(CH_3)_3$, and $OCOCH_2COOH$;

R_3 is selected from the group consisting of H, OH, OCH_3, OCH_2CH_3, NH_2, $NHCH_3$, $N(CH_3)_2$, NO_2, CN, CH_3, CH_2CH_3, $CH_2CH_2CH_3$, $CH(CH_3)_2$, $C(CH_3)_3$, F, Cl, Br, CF_3, SH, SCH_3, SCH_2CH_3,



2. The compound of claim 1, wherein

X is selected from S and O;

R_1 is selected from OH, OCH_3, and OC_6H_5;

R_2 is selected from H, OH, CH_3, and OCH_3; and

R_3 is selected from OH and 2-(1-piperidinyl)ethoxy.

3. The compound of claim 2, wherein X is S, R_1 is OH, R_2 is OCH_3, and R_3 is 2-(1-piperidinyl)ethoxy.

4. The compound of claim 2, wherein X is S, R_1 is OC_6H_5, R_2 is OCH_3, and R_3 is OH.

5. The compound of claim 2, wherein X is S, R_1 is OH, R_2 is OH, and R_3 is OH.

6. The compound of claim 2, wherein X is S, R_1 is OC_6H_5, R_2 is OCH_3, and R_3 is 2-(1-piperidinyl)ethoxy.

7. The compound of claim 2, wherein X is O, R_1 is OC_6H_5, R_2 is OCH_3, and R_3 is 2-(1-piperidinyl)ethoxy.

8. The compound of claim 2, wherein X is O, R_1 is OH, R_2 is OCH_3, and R_3 is 2-(1-piperidinyl)ethoxy.

9. A one-pot method for preparing a 2-(alkylthio)isoflavone comprising the steps of:

   a. providing a mixture of a deoxybenzoin, carbon disulfide, alkyl halide, and tetrabutylammonium hydrogensulfate;

   b. adding aqueous sodium hydroxide to the mixture while stirring;

   c. reacting the mixture until the 2-(alkylthio)isoflavone is formed.

10. The method of claim 9 wherein the mixture is allowed to stir for about 3 to about 7 hours after the addition of the sodium hydroxide.

11. The method of claim 9 further comprising the step of separating the 2-(alkylthio)isoflavone from the reaction mixture.

12. The method of claim 11 further comprising the step of purifying the 2-(alkylthio)isoflavone compound.

13. A method of prepararing a 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound comprising the steps of:

    a. selecting a 2-(alkylthio)isoflavone;

    b. optionally protecting potentially reactive groups on the 2-(alkylthio)isoflavone;

    c. oxidizing the alkylthio group to a alkylsyfonyl group; and

    d. substituting the alkylsulfonyl group with a heteroalkyl or heteroaryl group to form the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound.

14. The method of claim 13 wherein the oxidation step is carried out using *m*CPBA in a polar aprotic solvent under reflux conditions.

15. The method of claim 15 wherein the polar aprotic solvent is CH_2Cl_2.

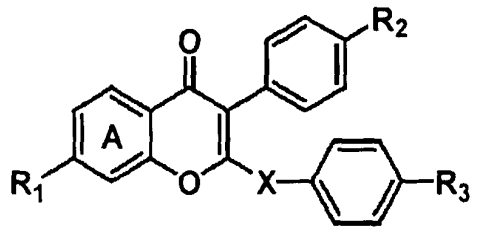
16. The method of claim 13 wherein alkylsulfonyl group is substituted with a thioaryl group.

17. The method of claim 16 further comprising the step of substituting the thioaryl group with an ethylpiperidinyl group to form a 4-[2-(1-piperidinyl)ethoxy]thiophenyl group at the 2-position of the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one compound.

18. The method of claim 17 further comprising the step of deprotecting the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one.

19. The method of claim 13 further comprising the step of deprotecting the 2-heterosubstituted 3-aryl-4H-benzopyran-4-one.

20. A method for treating, inhibiting, or delaying the onset of a cancer in a subject in need of such treatment; the method comprising administering a therapeutically effective amount of compound A:

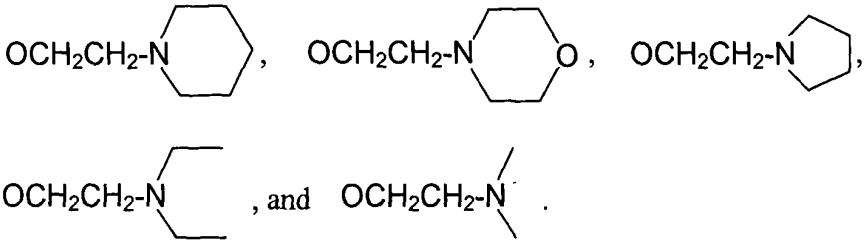


wherein

X is selected from the group consisting of O, N, S, SO, and SO_2;

R_1 and R_2 can be the same or different and are selected from the group consisting of H, OH, OCH_3, OCH_2CH_3, $OCH_2C_6H_5$, NH_2, $NHCH_3$, $N(CH_3)_2$, CN, CH_3, CH_2CH_3, $CH_2CH_2CH_3$, $CH(CH_3)_2$, $C(CH_3)_3$, NO_2, F, Cl, Br, CF_3, SH, SCH_3, SCH_2CH_3, OCOCH3, $OCOC(CH_3)_3$, and $OCOCH_2COOH$;

R_3 is selected from the group consisting of H, OH, OCH_3, OCH_2CH_3, NH_2, $NHCH_3$, $N(CH_3)_2$, NO_2, CN, CH_3, CH_2CH_3, $CH_2CH_2CH_3$, $CH(CH_3)_2$, $C(CH_3)_3$, F, Cl, Br, CF_3, SH, SCH_3, SCH_2CH_3,



to the subject in need of such treatment.

21. The method of claim 20 wherein the cancer is selected from the group consisting of breast cancer, leukemia, non-small cell lung cancer, colon cancer, CNS cancer, melanoma, ovarian cancer, renal cancer, prostate cancer, bladder cancer, and lymphoma.

22. The method of claim 20 wherein the cancer is hormone-dependent breast cancer.

23. The method of claim 20 wherein the compound suppresses proliferation of human breast cancer cell lines without significantly binding with estrogen receptors (ERs).